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AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 12.] SEPTEMBER, 1941. [No. 3.

EDITORIAL.

IN a recent White Paper on the use of economic resources in wartime, the Secretary of State for the Colonies directs particular importance to the training of agricultural demonstrators on whom progress may largely depend after the war. Soil erosion control work to protect the fertility of the soil is to be fostered generously as well as measures against crop diseases and insect pests which often cause losses that are difficult to assess. Also, the need for the stimulation of food production to replace imports is especially stressed.

What Napoleon said in regard to an army marching on its stomach is more true than ever in these days and the farming industry in the Empire is called upon to supply adequate food for millions of people, and also to supply raw materials for conversion into essential war materials. Agriculture thus plays a vital part in national defence, and so it can truthfully be said that our farmers are in the front line in the defence of freedom.

Local efforts are being made to stimulate additional cultivation of such staple foods as rice, yams, vegetables, milk, meat and other products, and in this connexion, special reference may fittingly be made to the intention of the Colonial Sugar Refining Company to permit each tenant to plant an acre of rice this season in their fallow lands as a war measure. This praiseworthy action should enhance the Company's reputation in the Colony and greatly assist in reducing our rice imports in the coming year.

In reference to food, an interesting note in this issue indicates that the Fijians in particular, and other small farmers, have been supplying necessary foods (fruit and vegetables) to local and overseas forces in considerable quantities, despite very adverse conditions caused by the February hurricane and its after-effects.

A list of leafy green vegetables contained in this issue tabulates some forty species in common use amongst the agricultural community as spinach though few of them are known to Europeans.

Many of these species are easily grown weeds, palatable to Europeans and form nutritious additions to the diet, especially in the dry zones where ordinary vegetables eaten by Europeans can only be grown with considerable difficulty. Attention is particularly invited to "poi," "baghi," kumala tops, 'kamoce,' tapioca leaves, cowpea leaves, "tubua," "bora" and wild mustard. The leaves of these plants make nutritious and palatable spinach and are well worthy of cultivation in the kitchen garden, if they are not already growing wild in the neighbourhood.

Like many other Pacific Island territories, copra production is, in Fiji, regarded as a main agricultural enterprise and the present shipping position is a decided hardship to all local planters of this crop. While all possible avenues for assisting this industry are being explored, it has not yet been possible to achieve any results or come to any decision as to its future.

It is believed, however, that the time has come when attention must be devoted to ways and means for improving the quality of our product, if it is to satisfy the buyer of the future, who is definitely tending to discriminate sharply between moderately good and really bad copra. An article by the Senior Chemist on copra quality and grading is a valuable contribution to our knowledge on this vexed question. It indicates that, in the hands of a skilled grader, the method of grading according to visible characteristics of the copra, as recently adopted at the request of the exporters, is, generally, a more satisfactory and practical guide to the quality of the copra than chemical analysis which cannot be carried out on large numbers of samples and is, in any case, descriptive of the copra at the time of analysis and not at the time when it may reach the crushing mill.

Under agricultural notes several interesting items of practical value are included. Potato variety trials carried out over a period of years show that the best of the varieties tried was the " Up-to-date," which is already grown on a useful scale in the Sigatoka Valley and efforts are being made to stimulate the cultivation of potatoes in other dry zones also.

A useful method of storing fresh fodder is described in a note entitled " Ensilage," which is worthy of study and imitation by stock owners in dry zones where green grass is sometimes hard to find.

Notes on electric fences and cemented bag buildings indicate practical and serviceable methods of effecting economies in farm building and fencing materials and should be of value to dairy farmers in particular, as well as to planters and others.

A brief report on Copra Grading at Levuka portrays the trends of quality in copra received at that port and the figures demonstrate the excessive dependence on unreliable weather conditions and the dire need for some form of artificial drier if the quality of the product is to be improved consistently.

Exact details on the various species of fruit-flies which occur in the Colony are always of importance, not only locally, but also for quarantine authorities abroad. The extreme rarity of a fourth fruit-fly is dealt with in the first entomological note, which is followed by particulars of a leaf-rolling caterpillar of tea, also found on roses and privet. Another note deals with a plant bug causing deformation of shoots of the useful egg-plant and the control measures adopted. This is followed by notes on the shot-hole beetle borers of posts, branches and seeds and the dependence of the economic entomologist on his systematic colleagues is well brought out as the local specimens had to be sent to a specialist in India. Application of a creosote paint was sufficient to repel further boring.

In regard to the efforts now being made by a number of coconut planters to produce more pigs, for which the local market is expanding, the need for more animal protein in the diet is stressed in a short note by the Senior Veterinary Officer, in which attention is directed to skim milk as the readiest method of supplying this requirement.

In conjunction with this necessary component in the diet of the pigs, it is pointed out that a good market now exists for butter fat in the form of ghee, which should form a useful subsidiary industry that could be established by planters, with little expenditure. Most planters already have cattle and ample grazing land and could quickly establish a dairy herd. The skim milk fed to pigs would promote rapid growth, with good bone and muscle development, features now obviously lacking in many of the pigs bred on coconut estates where the diet contains too much fat.

Planters should study the Senior Veterinary Officer's note thoroughly, as well as his articles on the nutrition of the pig published in the first issue of this *Journal* this year, since there is now a good market for pigs.

Treatment of eggs for the local market and measures worthy of trial with a view to improving local marketing prospects are briefly outlined in a note on limewater as a preservative for eggs and will prove useful.

Several reviews and extracts complete this issue and should provide interesting reading.

FOOD RESERVES.

By
H. W. JACK, O.B.E., B.A., D.Sc., M.L.C.,
Director of Agriculture.

On several occasions since the beginning of the war, His Excellency the Governor appealed to the people of the Colony to pay more attention to the local production of a greater quantity of the staple foods in common use. To these appeals there has been a definite response, especially by the Fijians, but there is still much room for the extension of the cultivation of local foods, especially by the Indian population. It is hoped that the latter community will seize the opportunity presented by the recent concession generously granted by the Colonial Sugar Refining Company, which permits their tenants to plant one acre of rice on their fallow sugar land in the coming season as a temporary war measure. This opportunity, if fully utilised, should go a long way towards substantially reducing imported supplies of rice, which at present occupy much valuable shipping space required for other purposes.

Exhortation to grow more local foods has also emanated from various other sources—the Secretary of State for the Colonies, the local press, and agricultural leaflets and this *Journal*. Just prior to the outbreak of the war, the Secretary of State for the Colonies stated that " The labouring population of the Colonies has not given enough time to the growing of food for consumption in the home market . . . . . that is not a sound policy. . . . . one of the things which we have to do in various Colonies is to make the people somewhat less dependent on the returns from export crops. We should encourage them to grow more of their food stuffs and to produce more nourishing varieties of local food stuffs for their own consumption, so that they can have fresh vegetables, fresh meat, and fresh fruit." The same authority in 1939 further stated that in formulating any scheme of agricultural development, importance should be attached to the adequate provision of locally produced food supplies in such variety as the requirements of a balanced and improved nutrition demand.

In June, 1940, this *Journal* pointed out that despite the lavish endowment of this Colony with highly fertile soil and abundant humidity, food stuffs that could be produced locally were annually imported to the value of over £200,000, a figure calculated from pre-war statistics. The main commodities imported were stated to be rice, tea, edible oils, canned meat, potatoes, onions, preserved vegetables, bacon, ham, pork, spices, pulses, biscuits, tinned fish, salt, coffee, cocoa, jams, pickles, etc. That was the position in peace time in Fiji, when ships were always available to carry imported food supplies. In war time the position is not so secure, since shipping may be required for essential war services, such as the transport of troops, munition and food supplies to the war zones. Obviously war requirements

must be given preference over everything else, and owing to enemy action, fewer ships are now available than in peace time. Further, many ships formerly employed in the transport of passengers and food and luxuries have now become converted into Armed Merchantmen and function as part of the Royal Navy, and the less food we import the more space becomes available for essential war purposes. In addition, the production of food in other countries for importation into Fiji may necessitate the employment of labour which is more urgently required for war work, so that surplus production may decrease, and, in any case, the cost of imported foods has had to be increased materially.

Fortunately, food stuffs imported into Fiji are chiefly derived from Empire sources, so that the matter of exchange complications is not serious but it is as well to remember that any money spent outside the British Empire reduces our purchasing power of war materials.

The cost of locally grown foods has increased considerably since the beginning of the war, and it would therefore be to the advantage of every family to grow even a little of its own daily food—in this connection it may truthfully be said that " where there's a will there's a way."

Town dwellers have little or no suitable land for the cultivation of food stuffs, and therefore are unable to produce any material proportion of their own food supplies. They can, however, if they persevere, produce some small quantity of food and it should be appreciated that every little helps, and such minor production is well worth every encouragement, even if it is limited to bananas, maize, lettuce and such supplementary foods. Every effort should, however, be made to grow a small plot of dalo or yams or sweet potatoes, and thus help to eke out those purchased food supplies like flour and rice, which have to be imported. Even if suitable land is not available, some vegetables may be grown successfully in boxes and whatever soil is available may be improved in fertility by the addition of compost made of rubbish, grass cuttings, rice husks, etc. It should be remembered that every little not only helps the war effort but also benefits the family budget in these times of rising prices. Full information regarding the cultivation of vegetables and the making of compost and other such matters may be had on application to the Department of Agriculture.

In a leading article in a recent issue of the local press, attention was directed to this subject and the necessity for taking precautions against any possible emergency in Fiji.

In regard to several items of essential foods which have to be imported, and even with such foods as rice, it behoves each householder to maintain in his house a constant supply for his own family needs sufficient for at least one week, in case of any unexpected emergency arising out of the war. In this connexion, it is suggested that a week's supplies for each household should include rice, local biscuits, flour, tea, tinned meat, tinned milk and sugar. If this precaution is taken—as it should be—it would greatly facilitate the distribution of food stuffs should any emergency cause a temporary disruption of trade, It is therefore the duty of every family to take the minimum of precautions along the lines suggested.

In addition, country stores can assist materially by maintaining slightly bigger stocks than normal of the above-mentioned commodities, most of which can safely be stored for several months without deterioration. Such patriotic action by storekeepers in country districts would be much appreciated by the general public, and would greatly alleviate the position, should an emergency arise.

FRESH FRUIT AND VEGETABLE SUPPLIES TO THE NEW ZEALAND FORCES.

By
A. B. ACKLAND,
Produce Inspector.

In October last the Director of Agriculture was entrusted with the task of organizing the supply of fresh fruit and vegetables to the overseas forces stationed at Suva. It was decided that purchases should, as far as possible, be made from exempted and other Fijian and Indian small-holders who did not participate in the supply to the civil population of Suva. This decision was made for two reasons, firstly, to provide a market for the exempted men whose market in New Zealand for kumalas and other produce had been lost owing to import restrictions in the Dominion, and secondly, to interfere as little as possible with normal supplies to the civilian population of Suva and to avoid the possibility of increases in price for those supplies.

The Fijian Co-operative Market at Nausori, under the supervision of the Agricultural Officer, Southern, undertook the collection and sale of the produce ordered and the bulk of the supplies have been produced in the Tailevu and Naitasiri provinces although Kadavu has supplied considerable quantities.

Most of the supplies have come from the cultivations of exempted Fijians but no restrictions have been placed on sales through the market by other Fijian producers living in the villages and Indians, provided they were not within the Suva area.

To those who are unaware of the extent of the production by small-holders in country areas an account of the varieties and quantities supplied through the Nausori market may be surprising. These details cover the period 1st November, 1940, to 1st July, 1941, and the March *Agricultural Journal* showed that 110,078 lb of vegetables and fruit were supplied between 1st November and 31st December.

Practically the whole of the 5,857 lb of English cabbage was supplied by Fijians at Kadavu in November and December last and did not represent special plantings to meet this new demand.

The firewood supply was organized by an exempted Fijian while the labour and the floating stock for transport were provided by the villagers in Daku, Rewa delta.

The hurricane which occurred on the 20th February last destroyed or damaged large quantities of vegetables and fruit crops and for some months it was impossible to meet the demand for fruit and vegetables in full. The vegetable supply is now normal but fruit is still difficult to procure and the demand cannot be met. It is estimated that supplies through the market would have exceeded £4,000 in value for the period concerned but for the damage occasioned by the hurricane.

The policy of the Department of buying in areas outside Suva as far as possible had the desired effect and local prices remained normal until the period of short supply following the hurricane, although an average of over three-quarters of a ton of produce was supplied to the forces daily.

From an agricultural point of view the decision to give the opportunity to Fijian small-holders, while not excluding others, has proved of considerable value.

In the areas concerned there has developed an increasing interest in the cultivation of a diversity of crops and in the maintenance of soil fertility by means of compost and farmyard manure. The experience thus gained marks an advance in current agricultural practice.

In addition, valuable contacts with growers of all classes over a considerable area has been made and the services available from the Agricultural Department have become more fully recognized and utilized.

Appreciation of the cordial co-operation of the Army authorities, who have been of much assistance in the smooth running of the undertaking, is expressed.

During the eight months under review the total weight of fruit supplied was 184,155 lb, valued at £885 19s. 11d., averaging 1·155 pence per pound, and of vegetables 239,360 lb, valued at £1,277 13s. 11d., averaging 1·281 pence per pound. The combined total of fruit and vegetables was therefore 423,515 lb, or 189 tons valued at £2,163 13s. 10d., averaging 1·266 pence per pound. 316½ tons of firewood was also supplied, bringing the total value to nearly £2,400 or £300 monthly.

FRUIT.

	lb		lb
Bananas	81,189	Passion fruit	140
Pineapples	23,540	Limes	221
Pawpaws	11,665	Lemons	4,821
Melons	32,314	Oranges	22,857
Rock Melons	39	Mandarins	6,160
Mangoes	100	Grapefruit	851
Grenadillas	258		
		Total	184,155

VEGETABLES.

	lb		lb
Tomatoes	4,862	Spinach	109
Cucumbers	23,838	Marrow	48
Lettuce	615	Sweet Corn	506
Celery	108	Squash	46
Radish	66	Leeks	20
Spring Onions	142	Taro	8,293
Cabbage	5,857	Yams	37,447
China Cabbage	9,215	Kawais (yam variety)	727
Carrots	305	Kumalas (Sweet potatoes)	73,906
Turnips	6,970	Coconuts	452
Parsnips	300	Breadfruit	2,147
Pumpkins	51,108	Duruka*	12
Egg Plant	651	Taro leaf (Rourou)	8,419
French Beans	333	Kumala tops	1,547
Long Beans	1,311		
		Total	239,360

FIREWOOD.

Firewood .. .. 316½ tons.

*Duruka is the Fijian name for the reed *Saccharum spontaneum* whose edible shoot is used like asparagus. For details see the *Agricultural Journal*, Vol. 9, No. 1, March, 1938. —EDITOR, *Agric. Jrnl.*

ALBIZZIA FALCATA.

By
J. S. SMITH, B.A.,
Conservator of Forests.

A LOG of *Albizzia falcata*, Backer (=*A. moluccana*, Miq.; Family, Leguminosæ) some 7 feet in length and 27 inches in girth was recently submitted to the writer of this note by the Director of Agriculture for comment. The parent tree had been grown at Waimaro, Tailevu, and was approximately 3 years of age.

The log was sawn "through and through" into boards of which the largest was 7 inches in width. The timber was white, soft and light and was similar to that produced by this species elsewhere. Heart-wood, which is normally dark brown was, as might have been expected, absent from the immature specimen under review.

Patches of blue fungal stain were distributed throughout the boards but this is a defect common to all timbers of this class in the tropics and is of no particular significance in the present instance.

In view of the fact that *Albizzia falcata*, is rarely seen in Fiji the following brief note may be of interest. The species is one of the fastest-growing known: trees two years of age are often 30 feet high and 6 inches in diameter, and trees ten years of age 90 feet high and 24 inches in diameter: a specimen in Ceylon, when 6½ years old, was 89 feet high and 6½ feet in girth. Lacking sufficient data it is impossible to suggest whether similar growth would occur in this Colony, though it is clear from the specimen submitted, that it does grow extremely rapidly when judged by normal standards.

The timber of *A. falcata* has been used for the manufacture of cheap matches in Java and is suitable for such temporary objects as fruit-cases. The wood has, however, a distinctly disagreeable odour which might be a disadvantage when used, for example, as butter boxes. It has also been examined for paper-making and can be utilized for this purpose though the product is of poor quality.

The possibility of growing this species in Fiji for the manufacture of fruit-cases is being examined and a number of trees have recently been planted to provide further information on the subject. Like all members of the genus *Albizzia*, however, the species is extremely shallow-rooting and it may prove unable to stand up to the gales commonly experienced here.

The tree itself carries only a light crown and because of this, and of its rapid growth, it has been extensively used in the East Indies as a shade tree for coffee and, to a lesser extent, for tea, It could probably perform a similarly useful function in gardens in this Colony, particularly in the dry-zones. It should not, however, be planted near wells as its roots are said to taint the water supply with a particularly nauseous odour.

ALBIZZIA FALCATA—A QUICK GROWING TREE.

By
W. L. PARHAM.
Agricultural Assistant.

DURING 1937 attention was being given to the increasingly acute shortage of firewood for Government stations and afforestation of the Vatukoula goldfield was also being discussed.

Officers in charge of country stations were advised to attempt the planting of woodlots on waste lands and the Department of Agriculture undertook experimental plantings upon its own stations.

In June, 1937, the writer suggested the importation of seed of *Albizzia moluccana* as in Fiji *Albizzia* had proved generally to be quick-growing and hardy. *Albizzia moluccana* is reputed to be the fastest growing tree in the world.

Late in 1937 two small packets of seed were received; one labelled *Albizzia moluccana* and the other *Albizzia falcata*. It was learned that both names referred to the same tree which is better known as *Albizzia falcata*.

The Waimaro Demonstration Farm was being opened up so the seed was sown at stake. An exposed hill denuded of soil was chosen and sowings completed early in 1938; four rows at eight foot spacing were planted, Maintenance was restricted to the normal cutting of grass.

In May, 1941, the trees were measured at 4ft. 6in. from the ground and the maximum girth was 32 inches and the minimum 6 inches. The average girth for 33 trees was 22 inches. Nine trees had been shattered by the hurricane of February, 1941 so could not be measured.

In no case was a tree uprooted owing to the notably large root-systems acting as " anchors."

The stem of one tree has been submitted to the Forestry Department.

During the clearing up after the hurricane in February immature seed-pods were found so there is reason to anticipate seed being obtainable locally nexteary.

NOTE: *Age of Trees.*—Sowing at stake, including re-supplies, was completed during first quarter of 1938, so the log cut was three years old.

Soil was a poor red subsoil owing to denudation by trampling of stock.

COPRA QUALITY AND GRADING METHODS IN FIJI.

By

W. J. BLACKIE, M.Sc., F.I.C., F.N.Z.I.C.

Senior Chemist, Government Analyst and Assayer.

FIJI copra in comparison with Ceylon, Straits Settlements, Dutch East Indies and New Guinea copra, in normal times commands a lower price, due to its poor quality. In some cases the quality is extremely poor and the good suffers with the bad, with which it is customary to mix it.

There is no doubt that the industry in Fiji suffers from many disadvantages, such as high internal freights, labour costs, high external freights due to the long distance of transport to overseas markets, and to some extent from lack of competitive buying. These limiting conditions have not improved within recent years, and further troubles due to shipping shortages and still higher plantation costs are now in operation.

Apart from these disadvantages, which affect in a similar degree copra produced in other countries, there is no doubt that the general grade of our copra is such that it is not acceptable when better quality is offering, and the time has come when we must supply the market with the better quality demanded by the purchaser.

During the past year many samples of copra have been submitted to the Chemical Laboratory for examination and careful chemical and physical examination have disclosed (*a*) extensive mould damage, (*b*) uneven drying,

(*c*) high free fatty acid, (*d*) considerable quantities of immature and vara "meat," (*e*) a fair quantity of foreign matter and (*f*) burnt and caramelised copra. In general, extreme lack of uniformity is a distinct feature of our copra.

It was mentioned above that we must supply the quality demanded, and it is therefore important to state briefly what constitutes good quality copra, and what factors influence the oil crusher in his buying.

Good quality copra contains from 66 to 68 per cent oil, 5 per cent moisture, less than 1 per cent free fatty acid, is pale in colour, consists of mature "meat," has less than 1 per cent dirt, is not burnt, is evenly dried, is regular in shape and size and is not rubbery. A small superficial development of moulds is unimportant, provided the moisture content is such as to limit all but superficial development.

Copra of this type can be produced in Fiji, and is produced on certain plantations by the careful drying of selected nuts (only fully ripe, brown, ungerminated nuts) both by artificial driers and, in some few cases, by sun drying. Where selection of nuts is not possible, a careful grading after drying—whereby badly moulded copra, immature and "vara" meat and dirt are removed before bagging—would do much to improve the grade.

From the view point of the oil crusher, the following factors are of prime importance:—

(1) The copra must contain the maximum quantity of oil.
(2) The oil must have a minimum of free fatty acid.
(3) The copra must not be charred or caramelised or rubbery.
(4) The copra must not contain excessive dirt or moisture.
(5) The "meal" must be clean and wholesome.

All these factors are intimately related and are discussed in turn.

(1) OIL CONTENT.

Copra from mature nuts contains from 65 to 70 per cent of oil depending upon varietal difference, soil, climate. Immature copra contains less oil, its high sugar content permits of greater bacterial and fungal spoliation, and its rubbery nature creates certain difficulties in oil extraction. In Fiji it is the practice to allow the nuts to fall naturally. This is a good practice, provided the nuts are all mature and ungerminated, and that the meat is cured immediately after extracting it from the nuts. However, many immature nuts fall and, moreover, collection is not always sufficiently frequent to prevent germination either on the tree or on the ground. Germinated nuts ("vara") although high in oil content are particularly liable to attack by moulds. [Blackie(1) and (2), Cooke(3)]. In Ceylon it is the practice to take the nuts from the tree before full maturity and allow them to mature in storage.

(2) FREE FATTY ACID.

High free fatty acid is occasioned by extensive mould development rendered possible by (*a*) delayed drying after extraction, (*b*) slow or intermittent drying and (*c*) presence of meat from germinated nuts. Mould damage to copra has been discussed at length by Blackie(1) and (2), Cooke(3) and others, and it is considered that in order to secure minimum damage from this cause, it is essential to dry the copra below 6 per cent moisture as rapidly as possible, without producing case hardening or scorching the copra. This means artificial driers must be used in the wetter districts of Fiji. It is possible for the expert to tell very closely the actual water content of the

copra from the amount and type of mould present in the copra and from the appearance of the fracture of the copra. Below 6 per cent of water a certain amount of mould growth may occur, but the action is purely superficial and does not penetrate the meat. Mould damage not only produces free fatty acid, but it destroys copra so that although the percentage oil content is not lowered, (in fact it is sometimes increased owing to the oil gradient of the meat as it approaches the rind) there is an actual loss of copra and therefore oil. The manufacturer, under conditions of extensive mould damage, loses oil and has to neutralize the acidity and remove the objectionable rancid products before the oil can be of general use. It is possible to find copra with a high free fatty acid and a low moisture content. This is due to the fact that as originally prepared, the copra was dried slowly and irregularly, thus allowing development of mould. Subsequently, the copra has been dried out on storage to an extent preventing further mould damage.

(3) CARAMELISED COPRA.

The oil manufacturer can put up with a lower oil content and adopt means to deal with moderate free fatty acid. It is impossible, however, to improve charred or badly smoked copra economically to render it suitable for the manufacture of edible products or better quality soaps.

(4) WET AND DIRTY COPRA.

Excessive dirt means that dirt has been purchased as copra, and expensive cleaning methods are necessary to remove this objectionable impurity. In low grade copra dirt frequently amounts to 2 per cent, or even more. Also, apart from the liability to further mould damage rendered possible by the presence of excessive water, each per cent of water over and above that characteristic of first grade means that a ton of water has been purchased as copra in each 100 tons of copra. Freight also had to be paid on excess of water and on waste dirt and dust.

(5) COPRA MEAL.

The " meal " produced by the extraction of the oil is a valuable cattle food provided it is produced from clean, wholesome, mature meat. If the meat is rubbery, the oil is not completely expressed and the meal produced contains a larger proportion of oil than is satisfactory for animal feeding. Moreover, meat that has been extensively attacked by moulds produces a rancid dirty coloured meal objectionable for the feeding of stock.

In Fiji, there are two schools of though in regard to the grading of copra, and many sound arguments for and against compulsory grading have been advanced by both schools. As long as the price is right and the market unlimited, all would appear to be well for " South Seas," but when the reverse conditions obtain and the market demands quality, then it would appear to be sound common sense to go for quality and grade.

Other countries, notably Ceylon, Straits Settlements and New Guinea, sell on quality or grade for quality, and recent developments in Fiji and the creation of a new market restricted to good grade Fiji copra has thrown aside all arguments, since the new market demands that we land copra with a free fatty acid content below 3 per cent calculated as lauric acid.

This demand raises the question of grading standards designed to arrive at a fair and equitable judgment of copra quality.

In accordance with what has been stated above in regard to the quality of copra and the requirements of the Oil Crusher, the Director of Agriculture introduced in 1938 a table (Table I) for the systematic grading of copra.

This table is based on the physical characteristics of the copra and the criteria for the assessment of grade are defined as colour, cleanliness, appearance, odour and moisture as dete mined by visual observation, smell, mechanical fracture and the burning test and subject to deductions for defective matter. It will be noticed from an examination of the table that the Inspector records his observation in the form of an arbitary number, and the grade of the copra is assessed by the addition of a number from each section and the multiplication of the result by five.

It was realized that the method is purely empirical, since it is not possible accurately to measure such features as colour, appearance and odour; moreover, the multiplication by five and the size of the unit in each section could lead to erratic results in the hands of unskilled inspectors. Further, although accurate chemical determinations of oil, moisture and free fatty acid are extremely valuable, chemical methods suffer from the following defects: (1) Quality is not alone defined in terms of free fatty acid, oil and moisture. (2) Chemical determinations limited to free fatty acid, oil and moisture give the position at the moment of examination and are suggestive only of the future trend in quality. (3) Chemical methods can be carried out only in a properly equipped laboratory by qualified Chemists. Chemical determination of oil, free fatty acid, moisture, percentage dirt, percentage immature copra and other defective matter percentage rancidity, percentage mould damage and mould penetration and an interpretation of such data would, no doubt, give the full story, but such work would be costly and impracticable with hundreds of samples.

Taking these matters into consideration, the chart was designed to give due weight in a simple and practical manner to the more objectionable characteristics of bad copra and to assess in a systematic manner the quality of copra in terms of market requirements.

In order to assess the value of the chart, samples of copra graded by officers of the Department and other interested people were graded in the laboratory and determinations of free fatty acid and moisture were made. Further samples of copra graded overseas were obtained, regraded and examined in the laboratory. The results of these tests and observations on the grading are discussed below.

COMPARISON OF FIJI GRADING SYSTEM WITH STANDARD GRADES OF COPRA OBTAINED FROM OVERSEAS.

Through the courtesy of a local firm, several samples of overseas grades were obtained and handed to the Chemical Laboratory for grading and water content. The origin of the samples was not disclosed to the grader at the time of grading.

In Table II this data are tabulated and assessed in accordance with the system defined in Table I, together with the moisture determined in the laboratory.

It will be observed in Table II that, with the exception of "Straits," the, moisture determined by chemical methods is below 5·50 per cent for good quality copra, and also local grading methods placed these samples in their world market categories.

COMPARISON OF GRADING DATA AND TOTAL GRADE POINTS WITH ANALYTICAL DATA FOR MOISTURE AND FREE FATTY ACID.

In Tables III, IV, V and VI, grade data for odour and moisture and total grade points are compared with analytical values for moisture and free fatty acid of the oil. The data for grading were taken from the reports of several Inspectors and are arranged in the three grades.

Considering the empirical nature of the grading assessment and the large personal and sampling errors involved in the grading of a heterogeneous product such as South Seas copra, it is evident that a fair correlation exists between the grade points and the analytical values. It is also evident that the appearance of the fracture, the snap, the odour, and the burning tests do, in general, give a measure of the water content and the free fatty acid, although individual divergence may be large.

It is further evident that there is some correlation between grade on the one hand as determined by the empirical method and moisture or free fatty acid on the other, but that with grading methods, it is possible that a sample of 3 per cent fatty acid and over may find itself in grade 1 or grade 2.

The reasons for this are obvious and are due to the following:—

(1) Chemical data for moisture and free fatty acid, as stated above, do not alone determine the quality of copra and both values simply measure two potential factors which may indicate the possibility of further deterioration of the meat, e.g. if drying is slow, free fatty acid may develop rapidly, reach a maximum depending on the irregularity of drying and finally halt when the moisture drops below 6 per cent.

(2) A large quantity of " vara " meat may selectively effect the free fatty acid, since copra made from " vara " if not dried rapidly is selectively attacked by moulds and in a chemical determination of free fatty acid may outweigh a practical grading opinion; and

(3) Immature meat with a rubbery consistency, if graded with good copra, may be penalized from the mistaken opinion that it possesses a high water content.

From these considerations it was felt that Inspectors might err under certain circumstances in arriving at the true grade, by not giving due weight to the amount and quality of " vara " and immature meat and other defective matter in the grading sample. Moreover, it is necessary to emphasize that with a heterogeneous mixture, such as South Seas, every piece of the sample must be examined in a systematic manner by officers familar with copra grades, if a reasonable and balanced opinion of quality is to be obtained.

In order to test these opinions and the value of the grading table, several samples of copra were obtained by a local firm and submitted to the laboratory for grading and determination of free fatty acid and moisture. Every piece of the sample was graded, dirt percentage assessed and immature and " vara " separated and independently graded. The results of these determinations are included in Table VII and an examination of the data discloses a better correlation, within the limits of the grading method, between grade points for free fatty acid and moisture as decided by grading methods and compared with chemical methods. Further, with the execption of Sample L, a closer correlation exists between total grade points and free fatty acid and moisture determined by chemical means. It would appear also, that in general, copra graded efficiently as 60 per cent or over contains less than 7 per cent of water and less than 3 per cent free fatty acid.

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TABLE I.

DEPARTMENT OF AGRICULTURE, FIJI.

COPRA GRADING TABLE FOR FIJI.

Average colour.		Cleanness.		Condition.		Smell.		Dryness.	
White	4	Very clean	4	Large, round, thick, smooth.	3	Sweet	4	Pearly lustre, biscuit hardness. 6 per cent or under.	5
Pale Grey.. ..	3	Slightly dirty or slightly smoked.	3	Small, irregular, thin ..	2	Slightly smoked and slightly rancid.	3	Breaks with dull snap dark pearly lustre. 6–7 per cent.	4
Light Brown ..	2	Dirty, mouldy, smoked	2	Very small, very irregular, very thin, dusty.	1	Smoked or rancid smell of undried copra.	2	Bends in breaking with dull thud. Faint water line. 7–8 per cent.	2
Dark Brown ..	1	Very dirty, very mouldy, very smoked.	1	Rubbery, torn distorted, shapeless.	0	Very smoky, very rancid.	1	Soft rubbery copra—distinct water line. Breaks with dull thud. 8–9 per cent.	1
Reddish Black, to Black.	0	Rotten, charred	0	....	0	Very rancid burnt ..	0	Soft, spongy, rubbery copra. Meat showing white break. 9–10 per cent.	0

N.B.—Improve the quality of your copra by the use of this chart:—

First grade .. .. 70–100 marks.
Second grade .. .. 50– 70 „
Ungraded .. .. under 50 „

Example—Colour, 2; Cleanliness, 3; Condition, 1; Smell, 2; Dryness, 4 = $\frac{12}{20}$ x 5 = 60 per cent = Second Grade.

In grading, half-points may be used where deemed to be the more accurate and deductions may be made for excessive defective as defined in the Copra Ordinance 1940.

TABLE II.

Source.	Colour.	Cleanness.	Appearance.	Odour.	Moisture.	Moisture Det.	Fiji Grade.	Overseas.
						%		
Samoa	2	2	1	3	5	4·52	2nd	H.A.D.
Samoa	2	2	2	3½	5	4·83	1st	H.A.D.
Samoa	2	2½	3	3	5	4·50	1st	H.A.D.
Raboul	2	2½	2	3	5	5·41	1st	H.A.D.
Mozambique.	1	2	2	3	5	5·50	2nd	F.M.S.
Ceylon	3	3	3½	3	5	4·21	1st	F.M.S.
Dutch East Indies ..	2	2	3½	3	5	4·65	1st	F.M.S.
Straits	2	3	3½	3½	4	6·65	1st	F.M.S.

F.M.S. = Fair Merchantable Sundried. H.A.D. = Hot Air Dried.

TABLE III.

GRADE 1.

DEPARTMENT OF AGRICULTURE, FIJI.

COPRA GRADING TABLE FOR FIJI.

Sample No.	Odour.	Moisture.	Moisture Det.	F.F.A. Det.	Grade.
			%		
1	2	4	5·09	2·04	70 1st.
2	2	4	4.41	3·28	70 ,,
3	3	4	6·03	2·24	75 ,,
4	3	4	5·91	2·37	70 ,,
5	3	4	6·60	0·89	70 ,,
6	4	3	7·30	0·74	70 ,,
7	4	3½	4·86	0·65	70 ,,
8	3	3½	6·15	0·81	72·5 ,,

TABLE IV.

GRADE 2.

DEPARTMENT OF AGRICULTURE, FIJI.

COPRA GRADING TABLE FOR FIJI.

Sample No.	Odour.	Moisture.	Moisture Det.	F.F.A. Det.	Grade.
			%		
1	2	4	4·47	3·98	65 2nd.
2	1½	4	4·54	3·98	62½ ,,
3	2	4	5·39	3.46	67½ ,,
4	1½	4	5·28	5·38	65 ,,
5	2	4	4·46	2·56	65 ,,
6	2½	4	6·05	2·51	65 ,,

TABLE V.

GRADE 3.

DEPARTMENT OF AGRICULTURE, FIJI.

COPRA GRADING TABLE FOR FIJI.

Sample No.	Odour.	Moisture.	Moisture Det.	F.F.A. Det.	Grade.
			%		
1	1½	4	4·91	5·18	60
2	2	4	5·56	3·94	60
3	1½	4	5·26	4·00	60
4	2½	3	6·55	1·03	57
5	3	2	7·10	..	60
6	3	2	7·30	..	60

TABLE VI.

UNGRADED 3.

DEPARTMENT OF AGRICULTURE, FIJI.

COPRA GRADING TABLE FOR FIJI.

Sample No.	Odour.	Moisture.	Moisture Det.	F.F.A. Det.	Grade.
			%		
1	3	2	7·30	..	47½
2	2	2	7·90	..	47½
3	3	5	5·82	..	47½
4	1	3	7·73	3·48	42·5
5	2	3	5·62	2·02	47·5
6	2	2	9·63	0·81	50·0

TABLE VII.

Sample No.	Colonr.	Cleanness.	App.	Odour.	Moisture.	Grade points.	Moisture.	F.F.A.
							%	%
A	1	2	1	2	3	45	8·18	4·36
B	1	1	1½	2	3	42	7·80	4·99
C	2	2½	2	2½	4	65	6·05	2·51
D	2½	3	2½	3	4	75	6·03	2·24
E	2½	2	1½	2	4	60	6·70	1·18
F	2	2	2	2	2	50	9·63	0·81
G	2	3	2	3	4	70	5·91	2·37
H	2	2½	2½	4	3	70	6·60	0·89
I	2	2½	2	3	3	62·5	6·55	1·03
J	3	3	2	3	4	70	7·30	0·74
K	2½	2	0	1	3	42·5	7·73	3·48
L	2	1½	1	2	3	47·5	5·62	2·02
M	2	2½	2	3	4	67·5	4.86	0·65
N	2½	3	2½	3	3½	72·5	6·15	0·81

Note.—In sample F it is obvious that the f.f.a. would finally materially increase on account of the high moisture content.

BOTANICAL NOTES.

1. LEAFY GREEN VEGETABLES IN FIJI.

By

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and

B. E. PARHAM, M.A., (Agricultural Officer, Southern).

The present note records such green leafy vegetables (other than the ordinary well known " European vegetables "), as have been noted in common use by Indians and Fijians in the Western and Southern Divisions.

The list of 40 species may, therefore, be regarded as representative of plants used as spinach throughout the Colony.

In both the dry and wet zones, the following plants have been noted. (F) = Fijian and (H) = Hindi equivalents:—

Cultivated by both Indians and Fijians—
" Dalo " (F)—*Colocasia esculenta* and
" Dalo ni tana " (F)—*Xanthosoma sagittifolium*—leaves and petioles.
" Bele " (F)—*Hibiscus manihot*—leaves.
" Pumpkin "—*Cucurbita pepo*—leaves.
" Kumala "—*Ipomoea batatas*—leaves.

Cultivated by Indians only—
" Mustard "—*Brassica nigra*—leaves.
" Methi " (H)—*Trigonella fœnum-græcum*—leaves.
" Roselle "—*Hibiscus sabdariffa*—leaves.
" Saijan " (H)—*Moringa oleifera*—leaves.

Joachim[1]—reports that the leaves of this tree are the richest of all leafy vegetables in organic constituents and a good source of minerals, besides being rich in vitamin C.

Wild plants used by both Indians and Fijians are the aquatic plants—
Water-Cress—*Nasturtium officinale* and
" Karamua " (H) or " Ota Karisi " (F)—*Ipomœa aquatica.*

Weeds of cultivation are also used viz.—
" Baghi," " Marsa " or " Chauraia "—*Amaranthus* spp. and "Amlonia " (H)—*Portulaca oleracea.*
" Kaumoce " (F) or " Chakwar " (H)—*Crotolaria* spp.

Ferns used by both races—
" Ota " (F)—*Atyrium esculentum* and " Turalo " (F).
Saulaki (H).
Fijians in the dry zone also eat young bamboo shoots.

In the wet zone the following also have been noted as in more or less common use as indicated:—

Cultivated—
" Poi " (H)—*Basella alba*—Indian spinach—an excellent all-the-year-round green vegetable.
Brassica chinesis—Chinese cabbage, a well known substitute for English cabbage, widely grown.
" Mircha " (H)—" Boro ni vavalagi " (F)—*Capsicum annum*, young leaves.
Fœniculum vulgare—Fennel, Leaves used by Indians.
Lactuca sativa—Lettuce, cooked with coconut milk.
Tapioca—*Manihot utilissima*—young leaves.

" Tulsi " (H)—*Ocimum basilicum*—young leaves.
"Agathi " (H)—*Sesabania grandiflora* a small tree grown about Indian homes—leaves rich in protein, minerals and vitamin C(1).
Cowpea—*Vigna unguiculata*—young leaves and pods cooked and eaten.

Ferns—Indigenous wild species—
" Boreti " (F)—*Acrostichum aureum*—young fronds.
" Lemarua " (F)—*Asplenium adiantiodes*
" Lalabe " (F)—*Athyrium accedens*
" Ota balabala " (F)—*A. maximum.*
" Ota Kalasei " (F)—*Coniogramme fraxinea.*
" Ota loa " (F) *Tectaria decurrens—Campium palustre.*

Weeds—
Tubua (F) *Amaranthus viridis*—the young leaves and stems are rich in iron and phosphorus and are said to be a good source of vitamin C(1).
Brassica napus—Wild Mustard.
Cardamine sarmentosa—a small weed of gardens. " Rogomi " (F).
" Tinpatia " (H)—*Centella asiatica,* a common weed, the leaves of which are reported to be rich in iron.(1)
" Tinpatia " (H)—is also the name of *Oxalis corniculata* which may be used in a similar manner.
Physalis minima—Wild Cape gooseberry.
" Makoiya " (H), " Boro " (F)—*Solanum nigrum,* a common weed eaten by both Indians and Fijians.
Talinum angulare, a succulent plant.

From the observations recorded above, it is obvious that there is a wide range of plants which may be used as substitutes for better known cultivated species. Among these are both weeds of cultivation and indigenous species, the value of which has been proved by experience and is generally well known to members of both races in Fiji.

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ENTOMOLOGICAL NOTES.

By
R. J. A. W. LEVER, B.Sc., (Hons.), D.I.C., A.I.C.T.A., F.L.S.

1. IDENTIFICATION OF A RARE FRUIT-FLY.

In a bulletin(1) devoted to the two local fruit-fly pests, Simmonds referred to a third as yet unidentified fruit-fly which, it was tentatively suggested, was closely related to a Samoan species. A specimen of this scarce insect taken by the writer in February, 1941, has kindly been identified by Mr. F. A. Perkins of Brisbane University as being this same fly, *Strumeta* (*Chætodacus*) *distinctus* Mall. which occurs not only in Samoa(2) but also in Tonga. As well shewn in Simmonds' coloured plate, this fly is easily recognized by its dark reticulated wings and the yellowish areas separated by a central dark brown bar on the abdomen.

It is interesting to note, as showing its local rarity, that only two specimens have been seen by the writer in four years' collecting in Fiji, its scarcity being therefore comparable with *S. curvipennis* Frogg. which has been shewn(3) to occur in the Colony but not to be even a minor pest of bananas.

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(2) Malloch, J. R.—1931. "Insects of Samoa", Part VI, Fasc. 7. London.
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2. A LEAF-ROLLING CATERPILLAR OF TEA.

Tea has been grown in Fiji since the middle 'eighties, $2\frac{1}{4}$ tons having been produced from 300 acres in 1885 (1) but despite this early start tea is still only a very minor crop locally, though its cultivation during war time is liable to increase. So far nothing appears to have been published about pests of tea in Fiji since 1915 when Jepson (2) dealt with a leaf-curler at Wainunu, Vanua Levu, which, however, he was unable to identify. In that year the attack was said to be very serious on the young leaves and it was assumed that this was due to an indigenous caterpillar which had become a pest only one or two years prior to 1915.

In 1937 the present writer found a few specimens of what was taken to be the same leaf-roller but they did not survive the somewhat lengthy journey from Wainunu, Vanua Levu, to Suva and so the moth was not reared.

A search was made in November, 1940, on tea plants at Nasinu and a green caterpillar found there turned out to be *Adoxophyes fasciculana* Wlk., previously recorded (3) from guava leaves which it rolls and destroys. This caterpillar is therefore either a beneficial or an injurious insect according as to whether it attacks guava (a noxious weed) or the economically useful tea.

The moth has a wing span of 15 mm. (three-fifth of an inch) and is buff coloured with wavy brown areas on the forewings. The caterpillar has since been recorded on rose and privet (*Ligustrum*) leaves on both of which arsenicals could be sprayed with less danger than on tea bushes though plucking is not being carried out at the moment.

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(2) Jepson, F. P.—1915. Pamphlet No. 16, Dept. Agric. Fiji.
(3) Lever, R. J. A. W.—1939. *Agric. Journal*, Fiji, Vol. 10, No. 2, June.

3. A CAPSID BUG ON BRINJAL.

Damage to the egg-plant, brinjal or baigon (*Solanum melongena* L.) was reported in September, 1940, and on investigation the stunted growth of the young shoots with consequent dieback was found to be due to feeding by the Capsid bug *Lygus muiri* Poppius.

A kerosene and soap emulsion spray gave effective control which was of some importance as the threatened failure of this crop would have entailed considerable expense in providing alternative fresh food for a number of internees for whose diet some green stuff was essential. On a subsequent outbreak spraying with white oil (one part in forty) was successfully used. The insect is orange-brown in colour, the hyaline (transparent) portion of the forewings have smoky tips; length, 4 mm., say

one-sixth of an inch. Other host-plants are dahlia petals and cowpea (*Vigna sinensis*) but the damage to these two was much less severe than to egg-plant.

Specimens of what is taken to be the same species were collected on lantana at Nukualofa, Tonga, and forwarded to the writer by Mr. W. Cottrell-Dormer. As eight species of this genus are recorded (1) from Samoa there are likely to be some undescribed species in Fiji, though several are probably common to the two groups of islands; some perhaps to Fiji, Tonga and Samoa.

The writer is indebted to Dr. E. L. Zimmerman of the Bernice P. Bishop Museum, Honolulu for kindly having this insect identified by a specialist in the United States.

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4. SHOT-HOLE OR AMBROSIA BEETLE BORERS.

The wood-boring ambrosia beetles were dealt with in a previous issue of the *Journal* (1) seven local species being named. These small beetles are attracted to the outer sapwood of freshly felled logs and therefore have different tastes from powder-post beetles which attack wood during seasoning.

The writer has recently been in correspondence with Dr. J. Nicholson, Division of Economic Entomology, Canberra and Mr. Brimblecombe of the Department of Agriculture, Brisbane, who very kindly submitted his specimens to Dr. C. F. C. Beeson of the Indian Forest Research Institute with the result that certain changes in nomenclature have been found necessary with a consequent reduction in numbers of local species.

The beetle referred to as *Xyleborus perforans* Woll. (2) does not really occur in Austro-Malaya, the borer responsible for damage in this region being correctly referred to as *X. testaceus* Wlk. This name has priority over *X. kraatzi* Eichh. more recently used (3) as a synonym for *X. perforans*. Hence in Fiji *X. testaceus* has been recorded as a pest of coconut boles, citrus trunks, twigs of *Hydnocarpus wightiana* (chaulmoogra) and more recently from logs of *Endospermum* sp. (kauvula) used to provide slats for banana cases. Its distribution in the islands of the Pacific Ocean is said to be (3), (4) from New Guinea through the Santa Cruz Islands, Fiji and the Society Islands to Hawaii; to these must be added Washington Island (5° N., 161° W.) from which isolated atoll the writer received specimens from fallen coconuts in August, 1937.

As showing the difficulty of separating species of the genus *Xyleborus* it should be noted that Froggatt (5) carefully distinguished between what he called the Island pin borer (*X. perforans* Woll.) and the hairy pin-hole borer (*X. hirsutus* Lea) though both of these are really *X. testaceus* Wlk.

The control recommended for reducing this borer to a minimum is to stack timber for as long as possible before use, ensuring maximum ventilation, as the seasoning of the wood consequent on free circulation of air kills the developing grubs. Fortunately no restriction is likely to be imposed on the importation into Australia of crates made from timber bored by this beetle whose presence in New South Wales has been recorded (3). In June the writer took a dark brown species of *Xyleborus*, 2·5 mm. in length, at a height of some 2,500 feet in the valley of Mount Victoria (Toma ni ivi). They were found in the fallen pointed seeds of *Podocarpus vitiensis* Seem. (dakua salusalu) and their determination is awaited with interest.

The larger shot-hole borer *Crossotarsus saundersi* Chap., previously recorded (1) from avocado pear branches and grapefruit trunks, has since been obtained from newly-barked logs of *Cynometra grandiflora* A. Gray ("cibicibi") and from branches of the hard wood "sacau," believed to be a species of *Sideroxylon*.

The large black Bostrychid *Xylothrips religiosus* Boisd. was also found at the same time boring in *Cynometra* posts and application of a wash made from creosote and paraffin was found an effective repellent. This tree is a third host to add to mahogany and avocado pear, previously (1) reported.

The writer wishes to take this opportunity of thanking the Conservator of Forests and the Assistant Conservator of Forests for assistance given both in collecting forest insects and for information about local silvicultural practices.

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(4) Beeson, C. F. C., 1940. Occasl. Papers, Bishop Museum, Hawaii, Vol. XV, No. 18. January.
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AGRICULTURAL NOTES.

1. POTATO VARIETY TRIALS.

By
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Senior Agricultural Officer.

As a dry zone winter crop for the local store and bazaar trade, particularly in the western townships, potatoes have been very popular for some years. Planting has been generally restricted to the Sigatoka valley, but may extend this season to Kadavu and the Labasa District.

The following is a brief account of variety and planting trials carried out by the Agricultural Officer and staff of the General Experiment Station, Sigatoka, over the past three years. It should be noted that, as seed potatoes cannot be stored in good condition from one season to the next under Fiji conditions, fresh seed must be imported each season.

In 1937 seed of six varieties was obtained from Papanui, New Zealand. Only a small quantity of each variety was available, the observation plots were small and were not replicated and the calculated yields per acre are, therefore, liable to considerable error. Yields and other observations were as follows:—

Variety.	Maturity in days.	Percentage of Quality		Shape, etc.	Computed yield per acre.
		Table	Seed		
					cwt.
Early Rose ..	91	90	10	Uniform oval	107
Robin Adair ..	91	70	30	Uneven, elongated, poor quality	48
Cut Grown Gamekeeper.	91	70	30	Uneven, elongated, good quality	65
Epicure	85	85	15	Mixed shape	52
Cliff's Kidney ..	85	80	20	Elongated	65
Supreme	91	80	20	Oval	65

An attempt was made to hold over seed from the above experiment until the following season, 1938. The seed tubers sprouted early in storage and it was necessary to plant in February to avoid loss of seed, though normally planting is not carried out until May or June. There is no record of the crop which was, however, very light and the tubers very small. Tubers of five of these varieties were replanted in July, with slight improvement in size of tuber, though the crop was again very small.

In 1939 seed of six varieties was imported from Northern Ireland and planted in an observation trial with six varieties obtained from Pukekohe, New Zealand, the same varieties as in the 1937/38 trials.

Variety.	Maturity in days.	Weight of 12 average tubers.	Shape and appearance.	Computed yield per acre.
Irish Seed—		lb.		cwt.
Up to date	75	3	Medium oval, excellent ..	74
Dunbar Standard	75	3	Medium oval, excellent ..	57
Arran Victory	75	2½	Small round, good. ..	47
Ulster Monarch	75	2½	Small oval, good	12
Arran Signet	(seed received unfit for planting)			
Arran Peak	75	2½	Small, long oval, good ..	20
New Zealand Seed—				
Cut Grown Gamekeeper ..	71	2½	Small round, good. ..	44
Sutton Supreme	70	3½	Medium round, good ..	25
Epicure	71	3	Round, good	52
Early Rose	72	5	Long oval, excellent ..	92
Cliff's Kidney	71	3	Medium kidney, good ..	52
Robin Adair	71	2½	Small oval, good	41

The Irish seed did not promise better results than that from New Zealand, since the high-yielding variety " Up to Date " is obtainable also in the latter country and is in fact already popular with growers in Fiji. Of the New Zealand varieties, Early Rose again showed up well, as in 1937.

In 1940 a trial of four varieties was conducted with New Zealand seed, this included " Up to Date " and " Early Rose " which had shown up well in 1937 and 1939 trials. The 1940 trial was designed with sufficient replications to permit of statistical analysis. This showed that, under the conditions of the experiment, " Up to Date " is significantly superior to the other three varieties under trial, as between which there is no significant difference.

Variety.	Mean yield in cwt.	Percentage yield compared with standard variety.
Up to Date	140·7±6·08	100
Early Rose	97·1±6·08	69
Inverness Favourite ..	95·1±6·08	67·6
Epicure	95·0±6·08	67·5

2. ENSILAGE.

By

H. R. SURRIDGE, A.R.C.Sc.(I)., B.Sc.

Agricultural Officer.

The manufacture of ensilage is an established practice amongst farmers of temperate countries, but in these islands of Fiji, various attempts made in the wet zone and spread over a period of years failed to produce other than well-rotted compost.

In August, 1940, however, this Department successfully initiated a further experiment at the General Experiment Station, Sigatoka, which is situated

in the dry zone, using the cheapest form of silo, viz. the pit silo and green maize at the "milk cob" stage, as the ensilage material. The ensilage was brought into use in March, 1941, seven months later. The rainfall between putting down the ensilage and opening up for use was 33·17 inches as against an average of 54·89 inches, over a period of 11 years.

The pit on opening up was found to contain ensilage of good quality as judged by leaf texture, colour—a faded green—and a pleasantly sweet aroma.

To test the palatability of this ensilage it was fed to working bullocks, horses and milch cows by the following methods:—

(*a*) by allowing stock free access to the raw ensilage;
(*b*) by feeding with the standard chop;
(*c*) by allowing resting stock free access to small quantities flavoured with molasses and placed in the feed boxes.

The results were as follows:—

(1) At the General Experiment Station, the stock refused or wasted the raw ensilage by simply picking it over.

At the Animal Quarantine Station, Suva, the Senior Veterinary Officer reported as follows:—

> "Two small lots of ensilage were received and fed to two cattle. One cow refused the feed whilst the other ate it with relish. No doubt it would be readily consumed by most stock once they become accustomed to it.
>
> The material had a good aroma and the structure of the leaf was clearly visible to the naked eye.
>
> Ensilage of the quality examined should prove a useful addition to the foodstuffs for animals in the Western Districts during the dry season."

(2) The ensilage was mixed with standard chop which consisted of chopped para grass (*Panicum barbinode*) and guinea grass (*Panicum maximum*) using 3 lb per head per feed for the first day and increasing up to 10 lb per head per feed by the fifth day. This was fed to all working bullocks, horses and milk cows. In this form it was readily eaten and no undue flavours were observed in the cow's milk.

(3) Small quantities flavoured with molasses were placed in feed-boxes freely accessible to resting stock who ate it with relish.

A total of 3,816 lb of this ensilage was consumed by five horses, 4 working bullocks and three milk cows over a period of three weeks, but this was insufficient visibly to effect any improvement in the condition of the stock but no ill-effects were observed.

These results demonstrate that with reasonable care a good quality ensilage can be made in the dry zones of these islands and therefore offers a means whereby the poor feed obtaining at certain times of the year may be augmented by the use of good ensilage to maintain the health and condition of stock in general, and working stock in particular.

The ensilage thus produced was prepared as follows:—

A dry site convenient to the stables was selected and a pit 9 feet long, 6 feet wide and 6 feet deep was dug, care being taken to make the sides perpendicular to ensure that in the filling the ensilage would be packed evenly and settle compactly. This is important since the more solid the packing the better the quality of the ensilage.

The floor was sloped to one side to allow for drainage of any liquor accruing from the ensilage material, thus avoiding the spoiling of the bottom layer.

On completion, the green maize at the "milk cob" stage was cut and carted to the silo where it was carefully packed in without further cutting,

in layers, being well trampled down in the process by the labour employed in the work. This was continued until the pit was fully packed when the loaded cart was then drawn across the pit to assist in consolidating the heap.

When no more could be worked into the pit, the top was covered with a thickness of about 12 inches of dried grass or straw, this in turn being carefully trampled. The objects of placing this material over the ensilage were:—

(1) To assist in excluding the air and (2) To keep the ensilage clean and free from the soil which was lastly heaped to a height of 2 feet to 3 feet over the pile and well trampled and shaped, to throw off the rain.

Finally a drain 18 inches was dug around the heap to take off any surface water or drainage, and thus assist in keeping the pit as dry as possible.

To open the pit, the soil was removed from one end to about 2 feet back and down to the dried grass. A sharp spade or cane knife was then used to cut through the grass which was removed, thus exposing the ensilage.

Cuts were now made down and along the face thus exposed, cutting out only sufficient for the day's requirements. After each day's cutting the top was carefully covered to protect against the weather.

The above process was repeated as each new face was worked and it was found that provided not less than 2 feet of the soil was first removed, the ensilage was not contaminated by the soil during the cutting out process. Further similar experiments are being conducted this season, using sugar cane tops and other green feeding material, report of which will be made available in due course.

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3. ELECTRIC FENCES.

By

W. L. PARHAM,

Agricultural Assistant.

For over a year two electric fences have been in use in Tailevu. These were introduced and utilized by Mr. Sachs of Korovou and Mr. F. R. J. Davies, the Head Master of the Provincial School Eastern at Lodoni, and both these gentlemen have kindly made available for these notes, the results of their experience.

Factors to be considered are that Tailevu is in the wet zone (average annual rainfall 119 inches) and that the local forests are lacking in durable fencing timbers. Numerous swamps discourage the use of concrete posts or of iron standards. Dairying is of the first importance in Tailevu which also has the densest native population of any Province in Fiji. Thus dairymen have to contend with a shortage of fencing materials in an area where native gardens abound. The owners of such gardens have little respect for fences but resent any trespass by cattle on their gardens and the law places the onus of fencing on the stock-owners.

Accordingly the trial in Tailevu of electric fences has been watched with interest. Mr. Sachs quickly proved the efficiency of his apparatus by controlling with a single barbed wire a bull which had previously broken out of every fence. The wire was strung from light stakes of guava (*Psidium*

Guajava) which is a common weed. The maintenance of the wire at a uniform height was found to be important.

The rank weed growth restricts extensive use of electric fences in Tailevu as weeding to prevent short-circuits is essential but it does appear that a training-pen can be utilized to train animals to respect wire. The Head Master of the Provincial School Eastern comments that the effect of shocks from the electric fence appears to be cumulative on both humans and on cattle. He also favours light fences so that an untrained animal may extricate itself if entangled. This is supported by reports from New Zealand where it is accepted that at the first shock an animal may break right out of a fence but does not face the fence again.

It is certainly encouraging that with both fences in Tailevu it has been possible to economize by using the apparatus intermittently. At the time of writing a pair of rogue bullocks owned by a Fijian are being trained to respect fences in the Lodoni pen and it is confidently expected that on return to their owner they will have ceased to be a nuisance. The average Indian or Fijian fence is a frail sort of barbed-wire entanglement so that their cattle are confirmed fence-breakers.

The electric fences in use in Tailevu are specially designed types in common use amongst farmers elsewhere. Doubts about the safety of electric fences appear to have been caused by reports of accidents due to the use of improvised apparatus connected to power lines. Electric fences came into common use in New Zealand about 1937, and have become so popular that one issue of the New Zealand *Journal of Agriculture* carries advertisements for six different makes of apparatus. Prices average about £N.Z.10 but range as low as 75s.

The New Zealand Department of Agriculture has given much attention to these fences and in the *Journal of Agriculture* has featured reports by Field Officers and by practical farmers. Perusal of these reports brings out the following points:—

(1) The majority of farmers are satisfied with electric fences.

(2) Wide spacing of fence posts (up to one chain) and reduction in number of wires are proved economies.

(3) Training pens are important.

(4) For cows one wire either plain or barbed at 3 feet 6 inches from the ground is adequate.

(5) Wire must follow inequalities of the ground.

(6) Insulation is important. An ecomony is possible by using strips of car-tyre as loops in place of insulators.

(7) Rationing of pasture by temporary subdivision is facilitated. Also new drains may be protected.

(8) Animals differ in susceptibility and in rare cases an animal proves unamenable and has to be disposed of.

(9) An ordinary car battery suffices for charging up to fifteen miles of fence for several months.

(10) Even pigs and dogs may be controlled.

SUMMARY.

Reports from New Zealand and observations in Tailevu suggest that electric fences represent control of stock coupled with great economy in fencing materials and in labour.

4. CEMENTED BAG BUILDINGS.

By

W. L. PARHAM.

Agricultural Assistant.

THE following "Practical Hint" appeared in "The Queensland Producer", Vol. 22, No. 22, issued on November 20th, 1940:—

"The chaff and cement bag can be turned to good use in the building of fowl houses or similar farm buildings of light construction according to the following plan which has proved successful in practice.

A framework of timber is first of all built up, after which wheat or cement bags are opened out and streched very tightly over it, being nailed down with ¾ inch clout tacks. Next a mixture is made up as follows:—

Water	1¼ gallons		
Cement	12 lb	[Fiji price	1s. 3d.
Lime	2 lb	,,	3d.
Salt	1 lb	,,	1½d.
Alum	½ lb	,,	4d.]

(In damp or wet weather use one pint less of water.)

"Sieve the salt and lime together through a fine sieve—to mix the materials thoroughly and get rid of any big lumps—add the water and then the cement —stirring while adding—and finally the alum. Wet the stretched bags with water and apply the mixture without delay, using a fairly stiff brush, first on the outside and then on the inside. Before the mixture sets, but after the initial wetness disappears, apply a second coat to the outside.

"The cost of the process, including bags for the foundations, works out at about 8d. a square yard. From this it will be seen that it is a very cheap and easy method of construction. Sheds built according to this plan three years ago show no sign of disintegration. Subsequent coatings will, of course, make a stronger board."

At the present time ordinary roofing materials are hard to obtain. Sawn timber is always expensive in Fiji, and the cemented bags are easier to fasten to a rustic frame than corrugated iron, for instance. As the cemented bag roofing offers the advantage of coolness, a trial was made with the construction of a small shelter. The result has received favourable comment and has proved both weathertight and neat.

It was found that the quantities given above sufficed to cover about thirty square feet of roof, giving coats inside and out. It was found advisable to give a second coat after a few weeks.

In mixing, the material was not sieved as that happened to be inconvenient but the lumpy sediment provided very useful grouting in concrete. Surplus mixture proved to be a very hard and attractive white-wash for concrete paths. It facilitates mixing in of the alum to dissolve the alum beforehand in water.

It seems to the writer that the utilization of material to hand to make a roof is as important as the question of comparative costs. In the country it is ussually possible to save the cost of sawn timber by making a rustic frame which is particularly suited for work with cemented bags and less skill is required.

5. COPRA GRADING.

By

C. HARVEY, B.Sc.(Agr.), A.IC.T.A..
Senior Agricultural Officer.

THE grading of all copra delivered at Levuka by the Agricultural Assistant, Mr. L. H. Dietrich, was continued during 1941. As previously, this was carried out in order to obtain information as to quality and had no bearing on price which, during this period, was at a flat rate of £3 10s. 0d. per ton. Grading was based on the following chart:—

Grade I	70 marks and over.
Grade II	50–70 marks.
Grade III	Under 50 marks.

2. The following table shows the total tonnage delivered at Levuka in each month, and the proportion graded in each grade:—

Month.	Total tonnage.	Percentage graded as		
		I	II	III
January	512	62	28	10
February	295	35	53	12
March	340	25	47	28
April	392	29	59	12
May	453	24	49	27
June	408	33	47	21

3. The marked deterioration in condition as evidenced by the fall in proportion graded as first quality is ascribed to wet weather and (latterly) to the presence of rubbery copra from immature nuts collected as a result of the hurricane.

4. Commencing in July of this year, the grading system was altered in consultation with the merchants, and at the latter's request, in order to provide a basis for purchase of copra at differential prices according to quality. Under this system only two grades are recognised and qualifying marks according to the grading chart are as follows:—

Plantation Grade	60 marks and over.
F.A.Q. Grade	Under 60 marks

5. The proportions of each grade received for grading at Suva and Levuka for July are as follows. It should be noted that under the old system *all* copra delivered at Levuka was graded, whereas under the new system only consignments nominated by the producer are graded:—

Place.	Total No. of bags.	Percentage graded as Plantation	F.A.Q.
Suva	4,733	66	34
Levuka	5,000	39·5	60·5
Total	9,733	52	48

The considerably higher proportion of Plantation copra received at Suva is partly accounted for by the delivery of a single large consignment of over 1,000 bags which was graded as Plantation. Other than this parcel, 55 per cent of the copra received for grading at Suva was graded as Plantation.

VETERINARY NOTES.

By
C. R. TURBET.
Senior Veterinary Officer.

1. SKIM MILK FOR PIG REARING.

In connexion with the effort being made by many coconut planters to produce more pigs, difficulty is being experienced in regard to the supply of animal protein, so necessary for the best growth and development of pigs. Animal protein is derived from either meat or fish, on the one hand or from skim milk on the other. It is difficult for farmers with a few head of stock to arrange for a constant supply of meat for their pigs, derived from their own property, and the purchase of imported meat meal is not economical in outlying districts. It seems, therefore, that the best souce of animal protein would be from skim milk.

The consumption of butter has increased so much during the last year that it is no longer necessary for the butter factories to convert excess butter into ghee, since all butter being manufactured is consumed as such. The result of this means that the ghee market will be under supplied. It seems reasonable to assume, therefore that dairying would offer to coconut planters a subsidiary industry which could be established with little expense. Ample land, and in most cases sufficient cows are already available on the coconut estates for the establishment of a dairy herd within a short time. In the meantime it would be necesssary for the dairy farmers to dispose or their butter fat as ghee, for which a ready market is available. Their skim milk would supply the animal protein, so much needed by their pigs and for the latter animals a very good market at present exists.

The effect of the feeding of skim milk to pigs is to promote rapid growth with good bone and muscle development. These features are at present lacking in plantation-produced pigs where so much of the ration is coconut. Pigs raised on this food show poor bone and muscle development and are prone to excessive fatness. The result of the addition of skimmed milk to the ration is that a carcass more approaching the type desired is obtained. One should note that skim milk and not whole milk should be fed. The skim milk is actually a much more valuable food than the whole milk under the conditions existent. To leave the butter fat in the milk would be wrong since it would further increase the tendency to over-fatness in the carcass. In considering the above notes farmers should refer also to two previous articles in the *Agricultural Journal*, dealing with the nutrition of pigs. These are:—*Agricultural Journal*, Vol. 8, No. 3—1937, p. 6; and *Agricultural Journal*, Vol. 12, No. 1—1941, p. 10.

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2. LIME WATER AS A PRESERVATIVE FOR EGGS.

Planters and others living in country districts who produce surplus eggs which would be marketable in Suva if it were possible to deliver them to the market in fresh condition, are doubtless troubled by the absence of facilities for the preservation of eggs. Twelve days is a maximum period during which eggs may be termed fresh. After that their deterioration becomes fairly rapid. In order to please distributors and consumers in Suva, eggs over six day's old should not be shipped to Suva. This will leave six days for the eggs to be marketed in Suva.

There will therefore be periods during which it is not possible to market the accumulation of eggs occurring in country districts when trasnport

facilities are not frequent. Preservation in lime water offers a cheap means to preserve these eggs.

" The oldest known method, and that which is most general in Europe, is by saturation of eggs in lime water. It is the process which is the least expensive. Although the shells are hardened by lime deposited upon them, that is an advantage in that on removal from the tanks the contents do not deteriorate rapidly, and, further, these eggs are easily distinguished as ' pickled,' as they are called. The solution is formed by mixing freshly slaked lime with water—say, one to two pounds of lime to five gallons of water, stirring the mixture two or three times per diem, until the whole forms a milky fluid, when a pound of salt is added to the above quantity. After allowing it to stand a few hours to settle and clear, the liquid is poured into the vats or tanks or tubs, which are then ready for the eggs.

" The virtue of the lime is to sterilize the water, which remains sweet and pure. The quantity of liquid required is not so great as might be imagined. The tank should be about a quarter full at first, adding more as required. The eggs should not be stored more than 4 inches from the top, and be entirely covered with the fluid, which forms a skin or film, and prevents dust or dirt reaching the eggs. In many cases boards are fitted to cover the tanks.

—"*Poultry Breeding and Production*" by Edward Brown. Vol. II, 1929.

Lime should be obtainable by most country residents by the process of burning coral. —C.R.T.

REVIEWS.

1. BANANA FIGS.

1. Fruit must be quite ripe and free of bruises. Over-ripe fruit will give sticky and discoloured figs.

2. Peeling must be done with a wooden, bamboo or stainless steel knife. May be facilitated by momentary immersion in boiling water. Divide fruit longitudinally into two sections.

3. *Drying.*—Sun-drying is useful, but unreliable, and, hence, artificial methods are best here. Any form of " tunnel " drier will do, but ventilation must always be good. Vacuum drying gives the best product, but equipment is expensive.

4. Colour and appearance of the figs is much improved by " sulphuring " before drying. This is done by exposing the peeled sliced fruit to the fumes of burning sulphur for 15 to 30 minutes in any kind of closed cabinet.

5. The product should be uniform in colour—pale yellow or golden—of pleasing non-sticky appearance and even consistency—no crust. Stickiness can be avoided by a light dusting with banana flour.

6. The drying temperature should never exceed 140°F.—a lower temperature is more satisfactory as long as drying is uninterrupted.

7. The dried figs should not contain more than 20 per cent of moisture, preferably about 15 per cent.

8. The figs cannot be packed in ordinary paper, but butter paper or cellophane may be used. Figs should be of uniform size in any one package so that it is best to grade the fruit for size before drying.

9. Well prepared and carefully packed banana figs may be stored for many months.

2. BANANA CHIPS AND FLOUR.

1. The fruit required is full sized but just under ripe. It is peeled easily after being plunged into hot (170°F.) not boiling water for 4 to 5 minutes. An ordinary steel knife must not be used.

2. Slice the fruit transversely into slices about one-tenth of an inch thick, then dry either by sun or artificial means, until the moisture content does not exceed 10 per cent. The temperature must not exceed 200°F.

3. The conversion of chips to flour is merely a matter of grinding by any available means.

4. Flour may also be made directly from the whole peeled fruit by pulverizing it to a paste, then drying quickly by passing the paste over hot rollers—this is a rapid method, flakes being produced which are easily ground to flour.

5. Chips may be stored in good condition for much longer than flour. Also, chips are more convenient for shipping—in jute bags lined with impermeable paper. —H.W.J.

—*Bulletin of Imperial Institute*, Vol. 39, No. 1, 1941.

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3. BIOLOGICAL CONTROL OF THE RHINOCEROS BEETLE.

Bull. No. 21, Dept. of Agriculture, 1941. Price one shilling.

THIS bulletin by the former Entomologist—Mr. H. W. Simmonds, O.B.E.—describes his mission during 1939 to Java, Malaya, Mauritius, Madagascar and Zanzibar in an attempt to obtain parasites and predators for the control of the rhinoceros beetle (*Oryctes rhinoceros* L.). Although this notorious pest is fortunately absent from Fiji yet its presence in nearby Samoa necessitates vessels arriving in Fiji from those islands having to anchor in midstream, well away from the wharf, between sunset and sunrise. Any control therefore of this beetle would be of benefit not only to this Colony but also to all countries whose vessels call at Fijian ports which are obliged to maintain this shipping embargo, inevitably resulting in much loss of working time and extra delay in handling cargoes.

The writer gives November 4th, 1910, as the first record of this beetle's presence in Samoa but H. J. Moors in " Tropical Life " for March, 1913, stated definitely that it was seen by him at the Customs House, Apia, in 1909 and had spread eight miles before the danger was realized.

The first predator sent to Samoa by Mr. Simmonds was a metalic green ground-or tiger-beetle (*Catascopus facialis* Wied.) 122 of these being released. Searches in Malaya failed to find any Tachinid flies parasitic on the grubs which are harmless scavengers in rotting vegetation, the damage being done by the adult beetle by eating the unfolded leaves or " cabbage." Nor in Malaya did the more hopeful Scoliid wasps prove to be true parasites of the rhinoceros beetle grubs and further searching in this region was accordingly abandoned. Work was therefore begun in Mauritius and Madagascar as it was clear that this Malagasy region is the most promising area for parasites, even the coast of East Africa not being too far afield for insect enemies of the rhinoceros beetle. Although this species comes from South East Asia yet Madagascar seems to be the centre of distribution of the genus which has about a dozen species, some being pests of various palms, sisal and sugar cane.

The result of the mission was that two consignments of the most promising parasite, the wasp *Scolia oryctophaga*, 210 females in all, were released in Samoa. This was the very insect recommended by Dr. K. Friedrichs (not Friedricks as in this bulletin) in 1913 and Madagascar was the island mentioned by the Military Governor of Western Samoa (Col. R. Logan) in September, 1916, as being the most profitable place to search for parasites—two good long range forecasts.

The route for the first lot was from Madagascar by plane to Portugese East Africa, up to Alexandria and thence across to Malaya and Australia so that the release of 150 robust individuals out of the 180 survivors was a good piece of work, especially when it is realized that war conditions hindered matters at Singapore. Ants in Mauritius nearly brought disaster to the grubs used for breeding.

This bulletin is the first departmental publication to be published outside of the Colony, the printing having been done in New Zealand. It contains three full page plates, one of which would, but for wartime economy, have appeared in colours, and the whole is a very well produced bulletin dealing with an interesting piece of entomological work whose outcome will be awaited by all those with interests in the South Sea Islands. —R.J.A.W.L.

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4. GREEN FOOD FOR POULTRY.

An article* of much interest to poultry keepers stresses the essential need of fresh green food, if poultry are to be kept in good health as good producers of good quality eggs. Also, green foods make for economical production.

Young leaves of grass weeds and other growing plants are valuable to the poultry, because of their nutritive natural juices, and the necessity for regular feeding of green food to growing stock cannot be too strongly advocated.

Green foods also build up the vigour of the fowls and their resistance to disease.

Variety in green food is, however, advisable since some green foods are of different feeding values from others so that access to a kitchen garden is advantageous or a variety of catch crops may be planted, cabbage, maize, rice, grasses, various beans, etc.

* In New Zealand *Journal of Agriculture*, Vol. 62, No. 5, 1941.

NOTE.

MAIZE AND HULLED WHEAT AS SUBSTITUTE FOR RICE.

An interesting article bearing the above title appeared in the last issue of this *Journal*. As the article is, however, liable to some misunderstanding, it should be mentioned that it was intended to stress the usefulness of maize and hulled wheat as substitutes for rice, when rice was very expensive and when native root vegetables were not available.

It is well known that maize as a staple diet has certain defects, including the low biological value of its protein (60 units compared with 80 units for rice), and its comparative lack of the anti-pellagra factor, but it does afford a useful standby when other staples are not economically available.

—H.W.J.